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SPECIFICATION

FOR
BRAYTON ISOTOPE POWER SYSTEM (BIPS)
ELECTRICAL OUTPUT POWER
CHARACTERISTICS

SC-76-312008

June 20, 1976

Prepared by: P. Post/WK

Approved by: C.L. Kevan

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SPECIFICATION
FOR
BRAYTON ISOTOPE POWER SYSTEM (BIPS)
ELECTRICAL OUTPUT POWER CHARACTERISTICS

1. GENERAL

1.1 Scope

This specification defines the Brayton Isotope Power System (BIPS) standards and characteristics for electrical power generation, required to be maintained at utilizing equipments power-input terminals, during generation and distribution.

1.2 Purpose

The purpose of this specification is to provide voltage and frequency limits and conditions to be used as criteria for BIPS electrical power system performance.

2. REFERENCED DOCUMENTS

2.1

The issues of the following documents in effect on date of invitation for bids, form a part of this standard to the extent specified herein.

SPECIFICATIONS

Military

MIL-E-6051

Electromagnetic Compatibility
Requirements, Systems

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STANDARDS

Industry

DO-160

Environmental Conditions and Test
Procedures for Airborne Electronic/
Electrical Equipment Instruments;

IEEE STD-100-1972

IEEE Standard Dictionary of
Electronic Terms

3. DEFINITIONS

3.1

Definitions of terms not explicitly treated are as shown in IEEE
Standard Dictionary of Electrical and Electronic Terms.

3.2 DC Power Characteristics

The designation dc power characteristics applies to voltages in
a direct-current, two-wire or ground return system.

3.2.1 Nominal dc Voltage

The nominal dc voltage magnitude is 120 volts.

3.3 Distortion

Distortion is the rms value of the superimposed alternating
voltage.

3.3.1 Distortion Factor

The dc distortion factor is the ratio of dc distortion to
average dc voltage.

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3.3.2 Distortion Spectrum

The distortion spectrum quantifies dc distortion in terms of the amplitude of each frequency component. The distortion spectrum includes the components resulting from amplitude and frequency modulation as well as harmonic and non-harmonic components of the ac waveform.

3.4 Electrical Power Characteristics

Electrical power characteristics include values and limits of voltage and frequency parameters, and include related characteristics pertinent to electro-magnetic compatibility requirements as well as those designated in ac and dc subcategories. These characteristics are representative of steady and transient states experienced in system operation during all phases of operation.

3.5 Electric Power System

The electric power system is that group of connected generation, distribution, protective and conversion equipments active in supplying electric power to utilization equipments.

3.6 Electromagnetic Compatibility

Electromagnetic compatibility is the capability of systems and associated equipment to perform at specified levels in the total electromagnetic environment.

3.7 Frequency

Frequency is equal to the reciprocal of the alternation period of the fundamental of ac voltage. The unit of frequency is the number of alternations per second of ac voltage and is designated Hertz (Hz.)

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3.8 Oversvoltage and Undersvoltage

Oversvoltage and undersvoltage are those voltages which exceed the combined steady state and surge limits and are usually terminated by the action of protective devices. Although generally short lived, these transients differ from surges in the sense that, if left unchecked, over and undersvoltage would continue indefinitely at a fixed magnitude or until some breakdown in operation was precipitated. Oversvoltage and undersvoltage can exist indefinitely at values slightly exceeding steady state limits but within the trip limits of generator protection circuits. These transients are generally due to loss of regulator control, unbalance, or faults, i.e., causes other than those producing surge voltages.

3.9 Ripple Amplitude

Ripple amplitude is the maximum value of the difference between the average and instantaneous values of a pulsating unidirectional wave. (See 2.1, IEEE Standard.)

3.10 Steady State

A steady state condition of the characteristics is one in which the characteristic shows only negligible change throughout an arbitrarily long period of time.

3.11 Utilization Equipment

Utilization equipment is that which receives power from the electric power system. It may be an individual unit, a set of equipments or a complete subsystem receiving power through common equipment terminals or power converters.

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3.12 Voltage Surge

The voltage surge is defined as a transient departure of the peak values of voltage from the peak instantaneous value of steady state voltage, persisting for periods in excess of 500 microseconds, followed by recovery to within peak values corresponding to steady state. Surges are caused by load changes, switching or power interruptions elsewhere in the system, and are not expected to activate protective equipment.

3.13 Voltage Spike

Spike is a transient of total duration normally less than 500 microseconds and is superimposed on the otherwise unaltered instantaneous voltage. Spikes may be characterized in time domain in terms of voltage with parameters of duration, risetime and energy. Spikes may also be characterized equivalently in terms of Fourier component amplitudes as a function of frequency. Spikes are not expected to activate protective equipment.

3.14 Reference Ground

The primary spacecraft structure is reference ground for the dc electrical power system. In some instances, it may be possible to utilize the negative polarity wiring of the dc system as ground.

3.15 Power Sensitivity

Power sensitivity of utilization equipment is the ratio of incremental output changes to incremental input changes for specified output performance quantities and specified voltage or frequency input-power changes. (See IEEE STD, 2.1)

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4. GENERAL REQUIREMENTS

4.1 System Equipment Compatibility

The characteristics defined in this specification shall be maintained at the U/E terminals during operation of all expected combinations of power source, distribution and utilization equipment. BIPS operating modes outside the conditions defined herein specification will be permitted only when specifically authorized.

4.2 Power Interruption

Due to conditions of bus transfer, voltage may be between zero and steady state limits for a period no greater than fifty milliseconds, and within the limits of Figure 5-2 following this interruption. Interruptions resulting from overvoltage and undervoltage or over-current may be followed by bus transfer, or by power restoration delays as determined by the particular application. (See 5.1.3)

4.3 Conformance Tests

Tests for conformance of the electric system to the characteristics stipulated in this specification shall be defined as part of the procurement specifications to which this document is applicable, and shall be subject to approval of the procuring activity.

5. DIGITAL REQUIREMENTS

5.1 DC Power Characteristics

Dc power characteristics are those of a direct-current, two-wire or ground return system having a nominal voltage of 120 volts.

5.1.1 Steady State

5.1.1.1 DC Voltage Magnitude

The dc voltage shall be within 110 to 125 volts.

5.1.1.2 DC Distortion

The dc distortion factor shall not exceed 0.025 nor shall the dc distortion spectrum exceed the limits shown in Figure 5-1. Ripple shall not exceed 2.5 volts (peak).

5.1.2 Transient

5.1.2.1 Voltage Surge

The maximum value of dc voltage surge shall not exceed the limits shown in Figure 5-2.

5.1.2.2 Voltage Spike

The system electromagnetic compatibility aspects of voltage spikes shall be controlled as defined in MIL-E-6051.

5.1.3 Overvoltage and Undervoltage

The dc overvoltage values shall not exceed the upper limits shown in Figure 5-3, and dc undervoltage shall be restored to steady state limits within 5 seconds after exceeding the lower limit of Figure 5-2. Interruption following the period of these overvoltages or undervoltages shall be as specified in 4.2. (See also 3.8, 3.12 and 3.13).

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SC-76-312008
Page 10